SPO
Special Projects Office

Spectral Sensing of Bio-Aerosols (SSBA)

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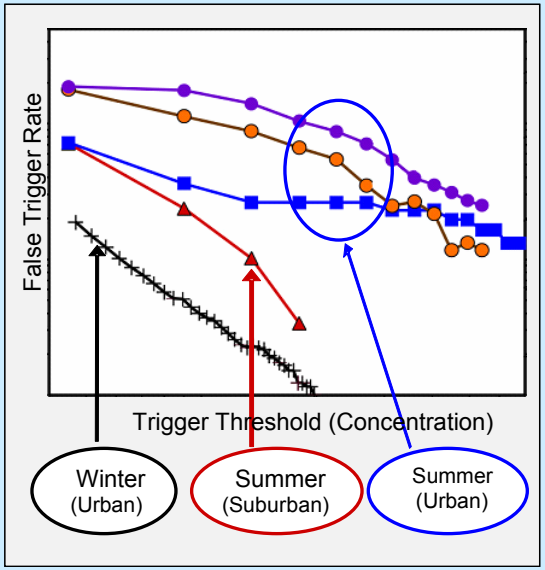
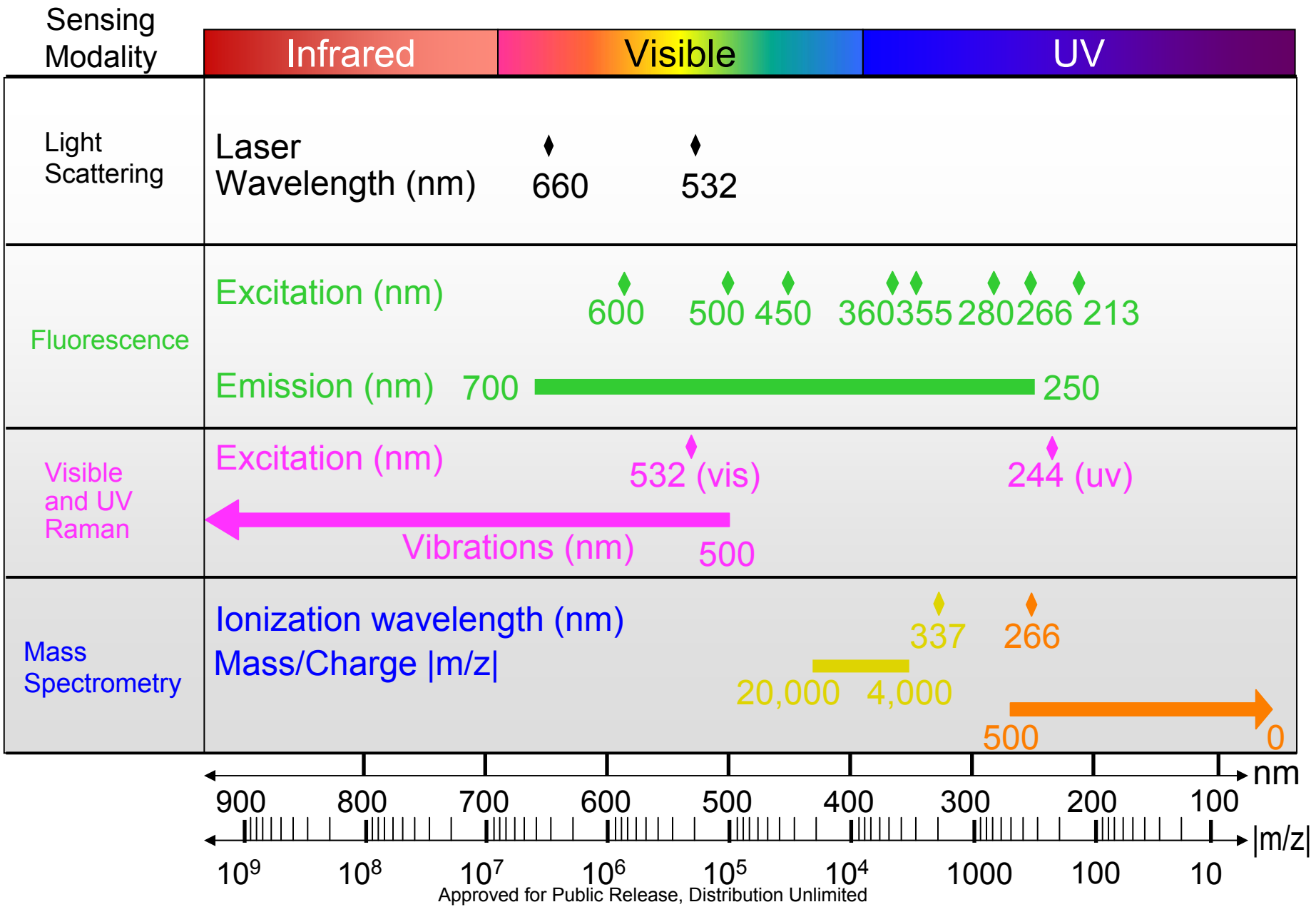
BW Aerosol Triggers

- Problem
  - The false alarm rates of currently fielded biological agent triggers are too high
    - BAWS alarms at a rate of 3/day in a cluttered environment
- Program goal
  - 100-fold reduction in false alarm rate relative to BAWS
  - Phase I Goal
    - 10-fold reduction in false alarm rate (P_{FA})
    - 20-fold reduction in false alarm rate (P_{FA}) for Mass Spectroscopy based methods
    - Probability of detection (P_D) that is 90% or greater
    - Time of detection (T_D) ≤ 1 minute
  - Phase II Goal
    - Maintain Phase I goal with 72 hr of stand alone operation
    - Goal has been changed to 1 wk of stand alone operation
- Methodology
  - Develop BAWS inspired false alarm recipes
    - BUG Trap: Air sampler designed to collect false alarm clutter
  - Test proposed sensor technology
    - Provide centralized testing system for technology validation with respect to BAWS using a GRT testbed
    - Collect bioaerosol signature
    - Test all proposed SSBA technologies
- Biosensor applications
  - The military requires biosensors in two main areas
    - Operations that require a high performance sensor with very low maintenance
    - Operations that require many moderate performance sensors but can tolerate some amount of maintenance and that can be readily interfaced to aqueous-based confirmation sensors

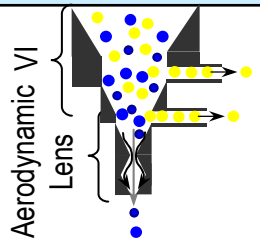
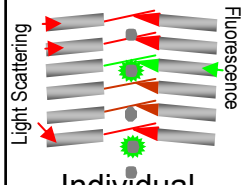
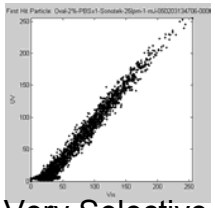
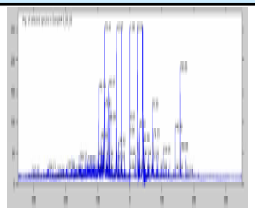
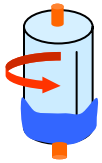
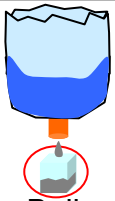
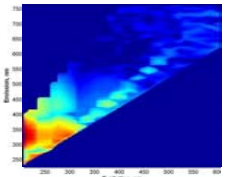


BAWS Device

Spectral Areas of Investigation



Sensor Concepts Overview

Performer	Particle Collection and Focusing	Individual vs Bulk Particle, Prescreen and Interrogation	Particle Prescreen Selection	Sensing Modality	Spectral Interrogation and Detection	Detection Algorithm
LLNL ***MS***		 Individual	 Very Selective	 MS	Ionization: 266nm Mass fragment: 0 - 500 |m/z|	Pattern Recognition and Rule Based Classifier
SPARTA ***Fluorescence***	 SpinCon	 Bulk	No Prescreen	 XM Map	Excitation: 213-600nm Emission: 250 - 700nm	Steady-State Principle Component Analysis

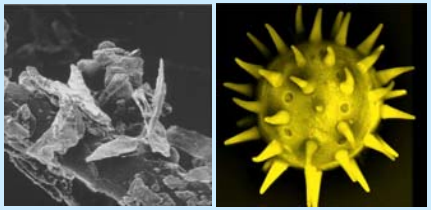
Testing Methodology: Bug Trap and Government Testbed

Bug Trap

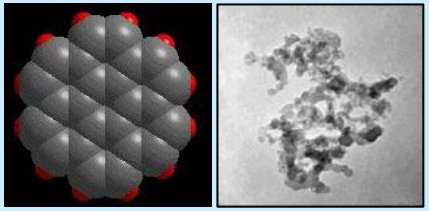
- Collect air samples for lab analysis when BAWS alarms
- Use collected air sample to determine composition for False Alarm Challenge (FAC)

FAC Composition

Biological Component

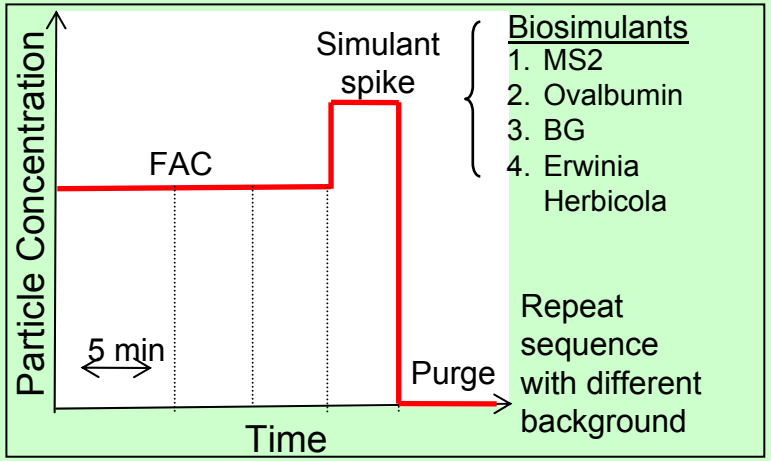


Chemical Component



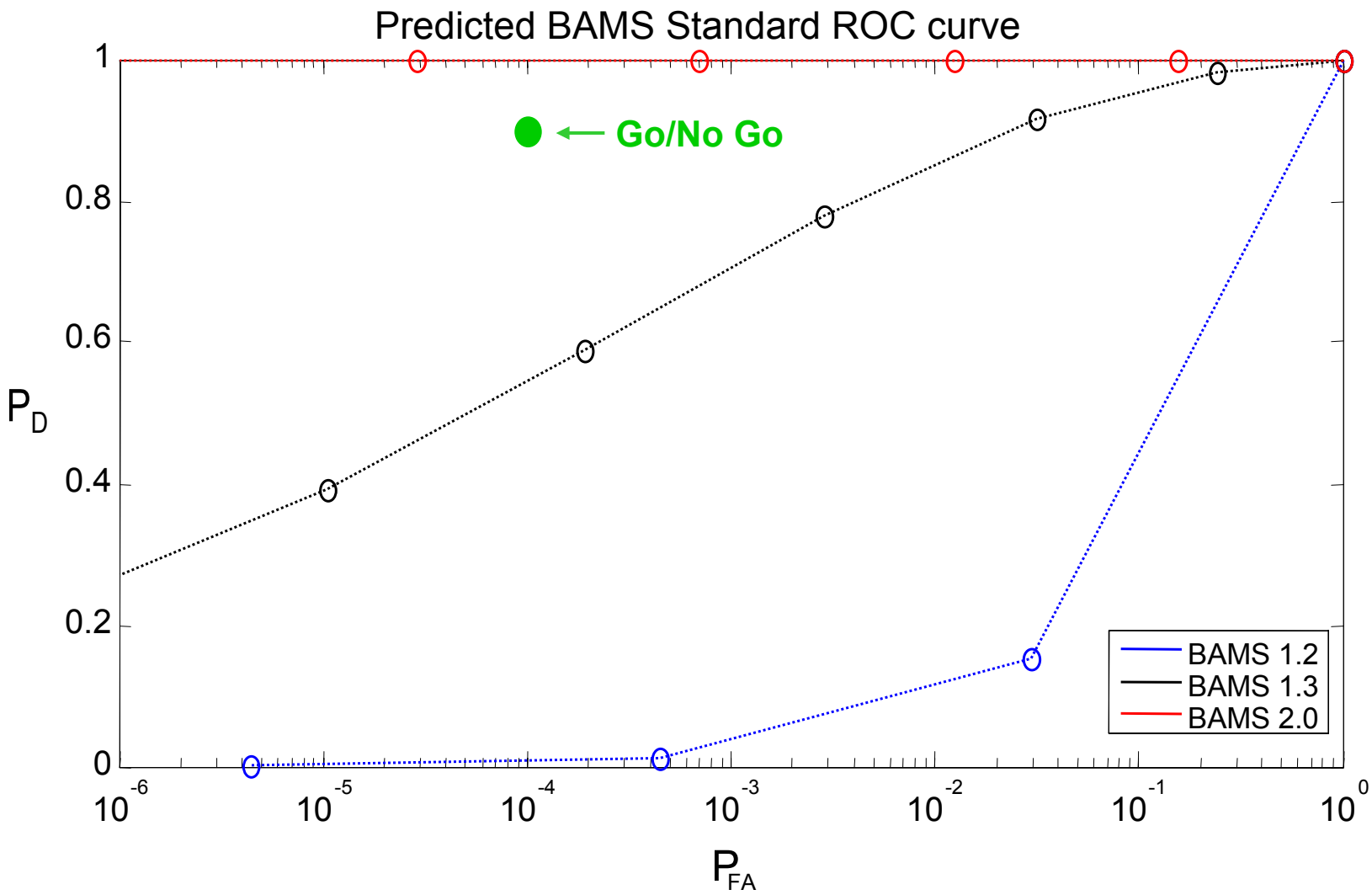
Government Testbed

Testbed Profile



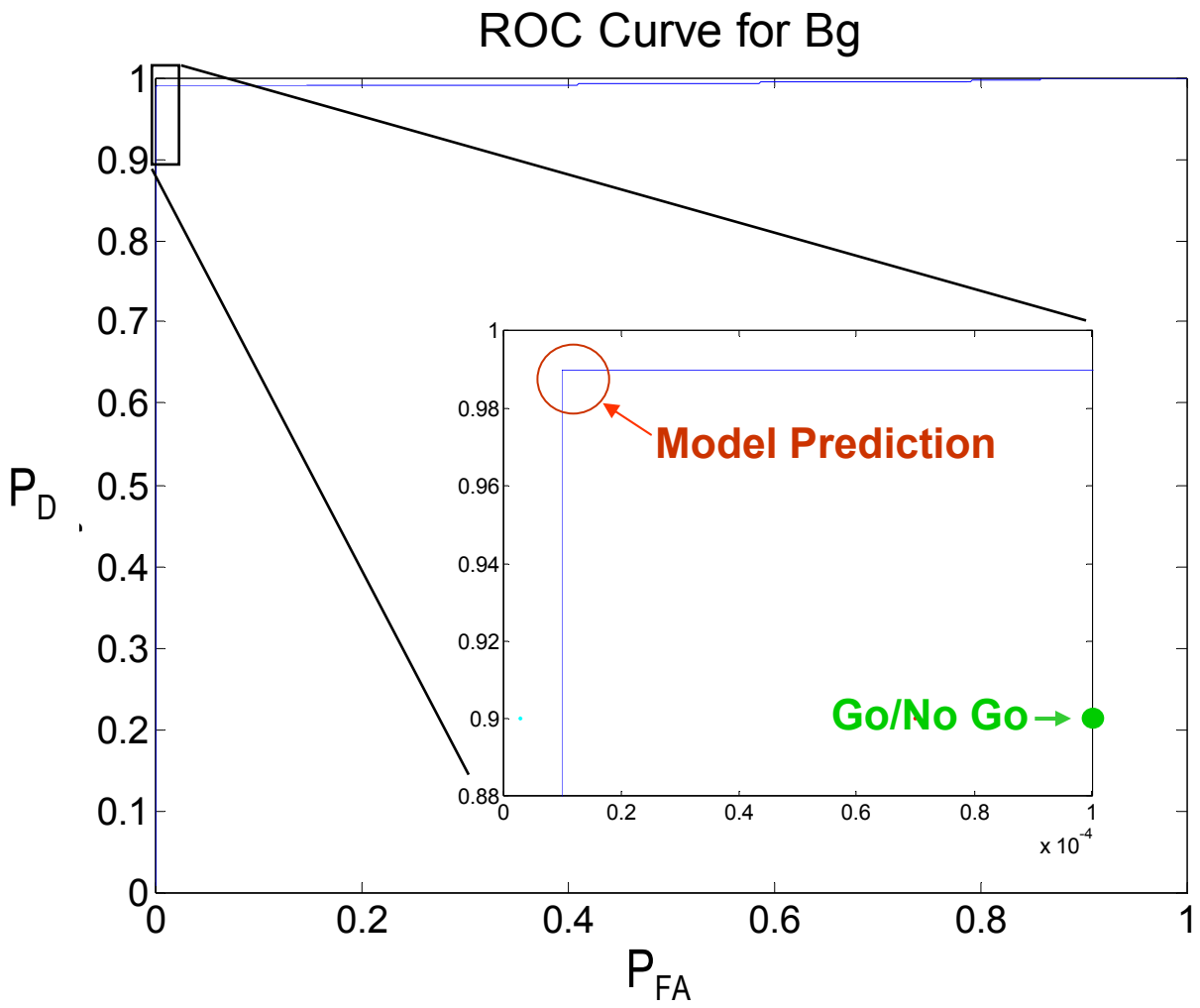
- Johns Hopkins Applied Physics Laboratory: Centralized testbed for evaluating candidate SSBA trigger sensor technologies
- Aerosol test facility:
  - Capability of generating a broad spectrum of aerosols representative of BW threat scenarios with typical background environments
  - Independent microbiological analysis of referee samples generated at the testbed

Phase I Results: LLNL Predicted ROC Curves



Model results show $P_{FA} \leq 10^{-6}$ for $P_D \geq 99\%$ and $T_D = 2$ sec

Phase I Results: SPARTA Predicted ROC Curve



Model results show $P_{FA} \leq 10^{-5}$ for $P_D \geq 99\%$ and $T_D = 20$ sec

Phase II Program Plan

- Develop biosensors for two different applications
  - High performance sensor with very low maintenance
    - High initial cost
    - Low operation and maintenance costs
    - LLNL BAMS device
  - Moderate performance sensors that need some amount of maintenance and that can be readily interfaced to aqueous-based confirmation sensors
    - Low initial cost
    - Moderate operation and maintenance costs
    - SPARTA XML device
- Phase II Go/No-Go
  - System demonstrates predicted performance over one week of stand alone operation
  - 4Q FY06